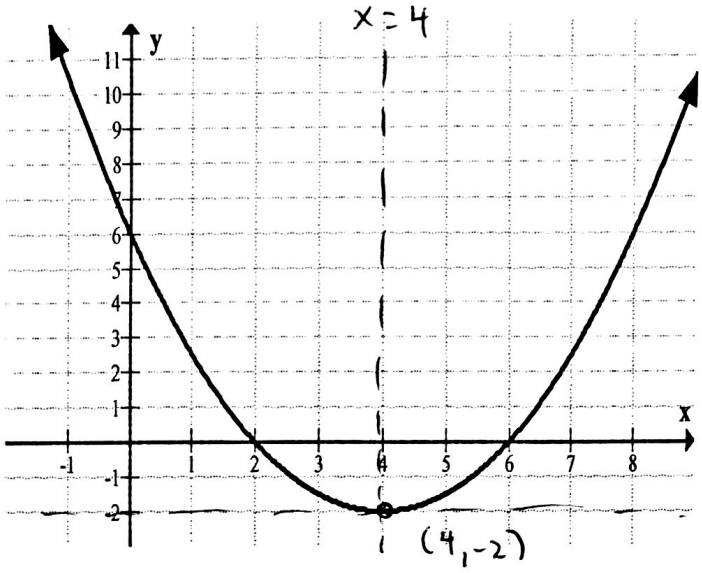
Quadratic Relations Summary | MFM2P

Identify all the key parts of the following parabolas:

a)



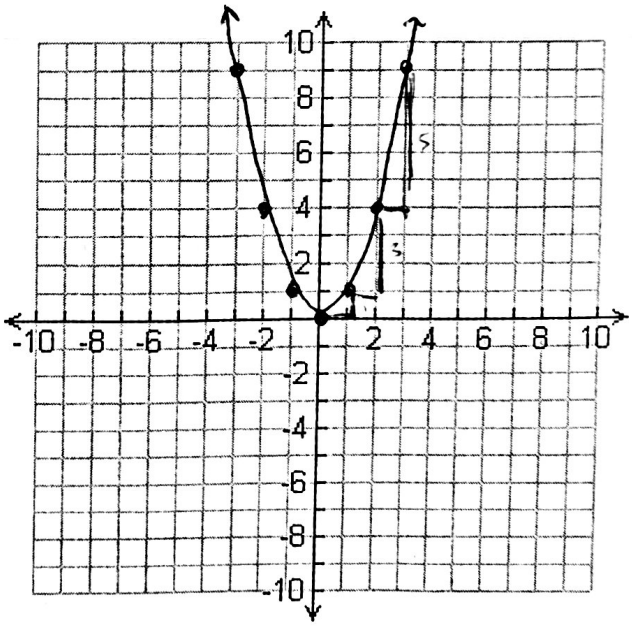
Vertex	(4, -2)
Axis of Symmetry	$x = 4$
Optimal Value	$y = -2$
x-intercepts	(2, 0) & (6, 0)
y-intercepts	(0, 6)
Direction of Opening	↑

VERTEX

After we talked about parts of a parabola, we looked at the equation of the **basic parabola.**

Relation	$y = x^2$
Rule: The y-values are the x-values squared	

Table of Values	
x	**y**
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



Vertex: (0, 0)

Step Pattern: 1, 3, 5

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We then looked at the graphs of other relations and came to the conclusion that if a graph was in **vertex form** we could read off the vertex, and the step pattern, and sketch the parabola easily.

$$y = a(x - h)^2 + k$$

Step Pattern: $1a, 3a, 5a$

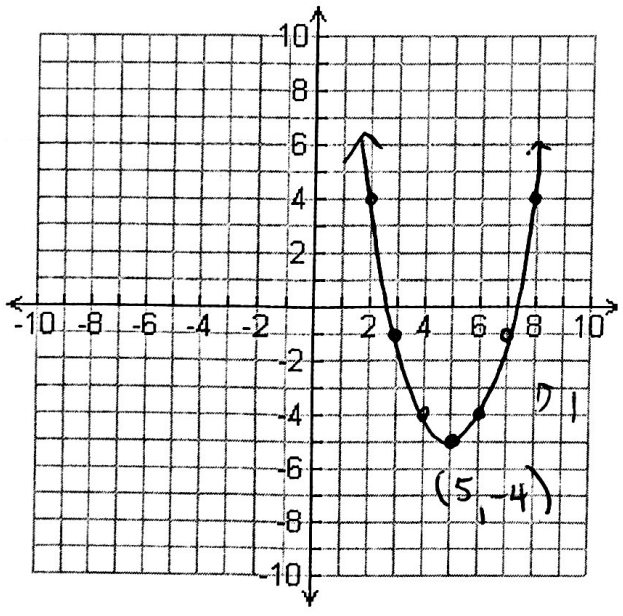
Vertex: (h, k) (switch)

Try and make a sketch of the following parabolas given the equation in vertex form:

a) $y = (x - 5)^2 - 4$

Vertex: $(5, -4)$

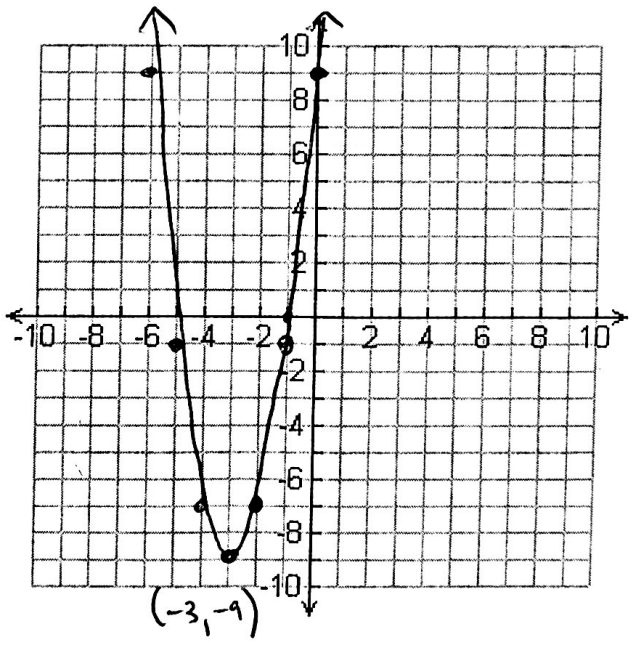
Step Pattern: $1, 3, 5$



b) $y = 2(x + 3)^2 - 9$

Vertex: $(-3, -9)$

Step Pattern: $2, 6, 10$



Finding the Equation of Quadratic Relation | MFM2P

So far, we have taken equations in vertex form, and produced a graph from it.

But what if we are given the graph or some other data, and need to determine the equation of the parabola? This occurs often in real life, as we usually obtain data of quadratic relationships first.

To get the equation of a quadratic relation in vertex form: $y = a(x-h)^2 + k$...
you need two things:

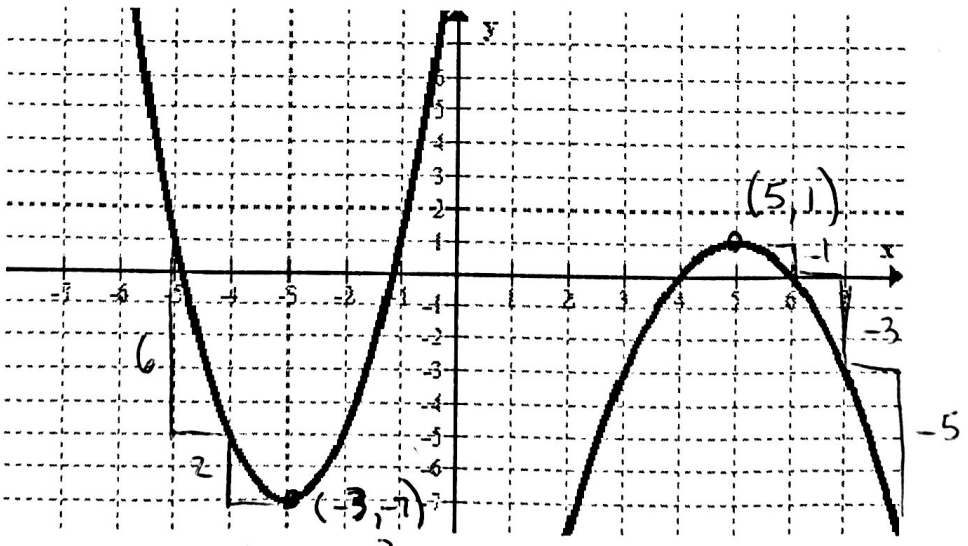
1) The vertex (h, k)
2) The step pattern $1a, 3a, 5a$

Example: If the vertex of a parabola is (-2, 4), and it has a step pattern of -2, -6, -10, what is the equation?

$y = -2(x+2)^2 + 4$ ← $a = -2$

In that example you were given all of the required information directly. But what if you are just given a graph?

Example: What are the equations of the relations below? Read off the vertex and step pattern straight from the graph.



Right graph: $y = -1(x-5)^2 + 1$

Left graph: $y = 2(x+3)^2 - 7$

Lastly, instead of getting a graph, you might only have information on the vertex and possibly one other point. We will have to use algebra to help us determine the equation.

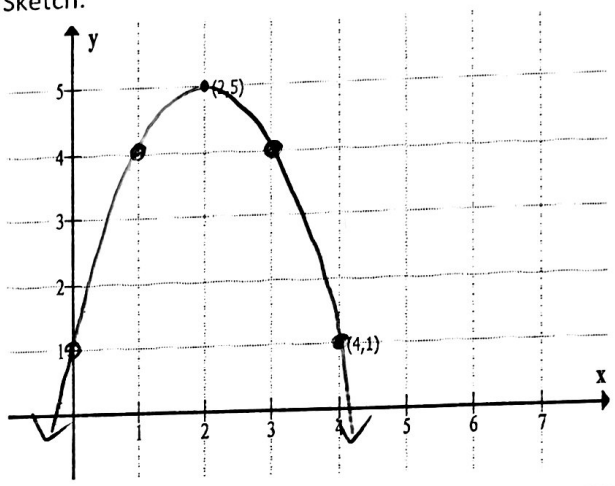
Finding the Equation of Quadratic Relation | MFM2P

Example: Find the equation of the parabola with a vertex of (2, 5) through the point (4, 1).

X Y

Vertex Form:	$y = a(x - h)^2 + k$
Sub in Vertex:	$y = a(x-2)^2 + 5$
Sub in Point:	$1 = a(4-2)^2 + 5$
Square and Solve:	$1 = 4a + 5$ $-5 \quad -5$ $-4 = 4a$ $\frac{-4}{4} = \frac{4a}{4}$ $-1 = a$

Sketch:



Equation:

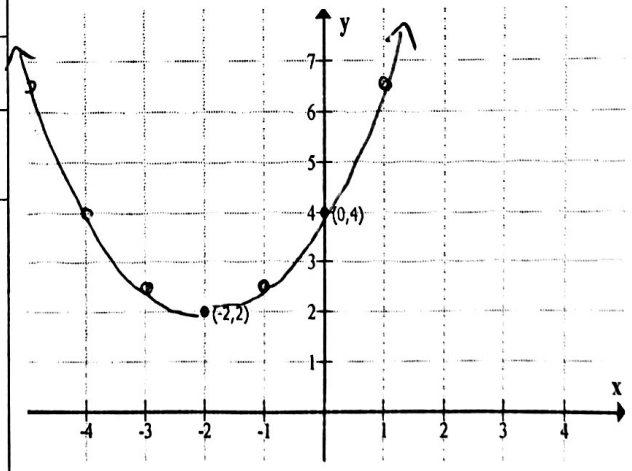
Equation: $y = \underline{-1}(x \underline{-2})^2 \underline{+5}$

Example: Find the equation of the parabola with a vertex of (-2, 2) through the point (0, 4).

X Y

Vertex Form:	$y = a(x - h)^2 + k$
Sub in Vertex:	$y = a(x+2)^2 + 2$
Sub in Point:	$4 = a(0+2)^2 + 2$
Square and Solve:	$4 = 4a + 2$ $-2 \quad -2$ $2 = 4a$ $\frac{2}{4} = \frac{4a}{4}$ $0.5 = a$ 0.5, 1.5, 2.5

Sketch:



Equation:

Equation: $y = \underline{0.5}(x \underline{+2})^2 \underline{+2}$